



Federal Aviation Administration

Memorandum

Date: May 6, 2014

To: Manager, International Branch, ANM-116

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Chris Parker

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Ignition Switches on a Dassault Aviation Model Falcon 5X airplane, FAA Project # TC00952IB-T

ELOS Memo #: TC00952IB-T-P-21

Regulatory Ref: §§ 21.21(b)(1), 25.1145(a) and (b)

This memorandum informs the certificate management aircraft certification office of an evaluation made by the Transport Airplane Directorate (TAD) on the establishment of an equivalent level of safety (ELOS) finding for the Dassault Aviation Model Falcon 5X airplane.

Background

Title 14, Code of Federal Regulations (14 CFR) 25.1145 (a) requires "Ignition switches must control each ignition circuit on each engine." Section 25.1145(b) requires "There must be means to quickly shut off all ignition by the grouping of switches or by a master ignition control." The Dassault Aviation Model Falcon 5X airplane does not provide individual flight deck switches for the control of each engine ignition circuit, as required. This requirement dates back to the Civil Aviation Regulations (CAR) 4b, and pre-dates the introduction of Electronic Engine Controls (EECs). Other modern aircraft have been certified without separate ignition switches for each engine following a finding of equivalent level of safety. On such aircraft, the ignition is controlled by the EECs and power to the ignition system is controlled by a means that also opens and closes fuel flow to the respective engine. In lieu of direct compliance, the applicant has provided automated features in the design that provide control and monitoring of each engine igniter and as such are proposed by the applicant to provide an ELOS to a design that would be directly compliant with section 25.1145(a) and (b).

Applicable regulation(s)

§ 25.1145(a) and (b)

Regulation(s) requiring an ELOS finding

§ 25.1145(a)

Description of compensating design features or alternative standards which allow the granting of the ELOS finding (including design changes, limitations or equipment need for equivalency)

The Dassault Aviation Model Falcon 5X engine ignition control system design uses a robust EEC and aircraft power relays to perform the igniter configuration functions instead of the pilot. The ignition control is by means of the throttle control unit and respective engine throttle lever position. The throttle STOP detent disables ignition and fuel to the engine. On the ground, the EEC software will automatically alternate each engine ignition system on successive starts and set an appropriate fault message if the ignition system is malfunctioning. In-flight, the EEC will command both ignition systems ON to start the engine, and set appropriate fault messages if the ignition system is malfunctioning. The EEC automatic control of the ignition is carried out through auto-start and auto-relight software logic. All EEC software is Level A and flight critical per DO-178B and is therefore shown through extensive testing to exhibit high reliability. An EEC failure of ignition control is remote and would only occur as a software error in the EEC, which would be anticipated to affect other features of engine control. As a result, the loss of direct control of ignition power, selection, or excitation due to an EEC software error will not directly impact safety of flight and is not impacted by the absence of manual ignition switches for each of the ignition circuits. The use of the EEC to select the igniter, to command power to the igniter and to monitor the igniter for faults during ground and in-flight starts, provides a level of safety equivalent to a pilot actuated flight deck switch for each engine ignition circuit.

Explanation of how design features or alternative standards provide an ELOS to that intended by the regulation

The incorporation of engine ignition control into the EEC simplifies the flight deck design and flight crew procedures. Pilots are not required to configure the igniters for ground and in-flight starts, or in adverse weather conditions, allowing them to focus on other tasks. The EEC auto-start and auto-relight software logic monitors engine core speed (N2) during all start attempts, ground and in-flight. The auto-start and auto-relight software applies corrective action if there is a failed start. Actions initiated by the auto-start and auto-relight software include flight crew notification, commanding igniters, and adapting fuel flow. The EEC commands dual-igniter continuous ignition ON for certain conditions on the ground and in-flight to assist re-light/starting or to prevent flameout. The automated EEC software function provides control and fault detection of individual engine igniter circuits, therefore provides a level of safety equivalent to a design that would be directly compliant with 14 CFR 25.1145 (a).

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in project Issue Paper P-21, titled Ignition Switches. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The TAD has assigned a unique ELOS memorandum number (see front page) to facilitate archiving and retrieval of this ELOS finding. This ELOS memorandum number should be listed in the type certificate data sheet under the Certification Basis section in accordance with the statement below:

Equivalent Level of Safety Findings have been made for the following regulation(s):

§ 25.1145(a) Ignition Switches

(documented in TAD ELOS Memorandum TC00952IB-T-P-21)

Original signed by Victor Wicklund

Transport Airplane Directorate,
Aircraft Certification Service

May 6, 2014

Date

ELOS Originated by: Propulsion/Mechanical Systems Branch	Project Engineer: Chris Parker	Routing Symbol: ANM-112
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